Remarks

Claims 1, 3, 4, 9-14 and 20-28 are pending in the application.

In the Office Action, claim 1 was objected to because the limitation "comprised of substantially non-optically absorptive material" was found to be unclear. Claim 1 is now amended to recite "low optical absorption material" as suggested by the Examiner. Accordingly, the Examiner is now requested to withdraw the objection.

Claims 1, 23 and 28 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite.

With respect to the limitation of "identical laser emission portions" in claim 1 being deemed indefinite, claim 1 is now amended to recite "laser emission portions each having the same construction relative to one another".

The Examiner also stated that the limitation of "equidistantly optically coupled" was unclear. Claim 1 is also now amended to state that the first wave-guiding layer is "spaced by an equal length or distance in an optical direction to the active layers of the plurality of laser emission portions so as to provide an equal passage of time of light thereto from the active layers".

With regard to claim 23, the limitation of "equivalent refractive index" was deemed to be unclear. Accordingly, claim 23 is now amended to state that "each of the plurality of second wave-guiding layers of the input waveguide region has a predetermined refractive index".

With respect to claim 28, the limitation of "like laser" was deemed to be unclear. Claim 28 is now amended to recite "a semiconductor laser region including a plurality of laser oscillation portions each having the same construction relative to one another."

Furthermore, insufficient antecedent basis was found to exist in claim 28 for the recitation of "the third layer of the output waveguide reigon". Accordingly, claim 28 is now amended to include an additional recitation of "an output waveguide region including a third wave-guiding layer coupled to said second wave-guiding layers".

Accordingly, all of the rejections under 35 U.S.C. 112 have now been addressed and therefore the Examiner is requested to reconsider and withdraw the rejection.

Claims 1, 3, 4, 9-12, 21, 23-26, and 28 were rejected under 35 U.S.C. 102(e) as being anticipated by *Kudo*. Claims 13 and 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over *Kudo* in view of *Towe et al.* Claim 20 was rejected under 35 U.S.C. 103(a) as being unpatentable over *Kudo* in view of *McFarlane et al.* Furthermore, claims 14 and 27 were rejected under 35 U.S.C. 103(a) as being unpatentable over *Kudo* in view of *Mazed*. It is respectfully submitted that these rejections are now overcome for the following reasons.

The present invention is directed to a semiconductor laser element including a plurality of laser emission portions each having the same construction relative to one another and being arranged side-by-side in a

parallel array and wherein each of the laser emission portions include an active layer for emitting light. Each of the laser emission portions are provided with a single common electrode, and each of the laser emission portions is connected to a multi-mode interference (MMI) region including a first wave-guiding layer, wherein one end of the first wave-guiding layer is spaced by an equal length or distance in an optical direction from the active layers of the plurality of laser emission portions. Since all of the laser emission portions are provided with a single common electrode, a common waveguide is provided for all of the laser emission portions which oscillate at the same wavelength so as to obtain the largest possible gain, whereby the respective individual wavelengths do not have any deviation from a common wavelength as a result of manufacturing tolerances, and since wiring is connected at only the common electrode, no jitter is generated due to irregularity of wiring lengths when high speed modulation signals are applied.

Simply stated, in the present invention each of the laser emission portions are physically and electrically identical to one another. It is to be noted that all of the plurality of laser emission portions 10d as shown in Figure 1 are equal in length when connected to the multi-mode interference region 10a. In Figure 1, the laser emission region 10b and the MMI region 10a are in contact with each other so that the distance between them is zero since they are in directed contact with one another. In Figure 6, all of the equal length waveguide regions 20g of the input

waveguide region 20f connecting the laser region 20b with the MMI region 20a, are of the same length. Thus light emitting from each laser emission portion is simultaneously fed into the MMI region without any time lag therebetween thereby substantially eliminating jitter upon the application of high speed modulation signals. Optimum power is generated since all of the laser portions operate at the same wavelength, in phase without jitter.

Considering now the references, the *Kudo* reference fails to disclose or suggest the essential features of the present invention and merely discloses an arrangement wherein all of the laser portions are provided with individual electrodes to oscillate respective laser portions <u>independently</u>, whereby the wavelengths of each of the laser portions can vary slightly with each other. Also, because of manufacturing tolerances it becomes difficult if not impossible to generate the same wavelength in all of the laser portions and where the laser portions are modulated at high speed, jitter is generated as a result of the phase difference of the signals based on the difference of wiring length from a driving circuit to the respective laser portions.

In the present invention, since each of the laser emission portions is optically connected equidistantly with the MMI portion, no time delay is generated, thereby eliminating any time difference between guide waves, thus reducing jitter when high speed modulation is applied because the respective laser emission portions are optically identical to

one another. The *Kudo* structure, on the other hand, is provided with an optical multiplexer region so that light irradiated from each of the laser portions enters into an MMI region with time differences relative to each other.

Accordingly, applicant's invention as now claimed is totally different from the structure of *Kudo* which has an object of providing a <u>multiple wavelength</u> communication system., It is submitted that *Kudo* fails to disclose or suggest the features of the present invention which overcomes the problems associated with high speed modulation, high power output, and time delay of laser emission which results in, among other things, jitter.

With respect to the secondary references, *Towe et al.* merely discloses the concept of wave-guiding layers being formed of AlGaAs. *McFarlane et al.* merely discloses the concept of a fully receptive dielectric layer located between a laser active region and a waveguide region. *Mazed* discloses the concept of applying a modulation signal to a laser chip via a plurality of discrete RF OC transmission lines, but not a single common transmission line or electrode as now claimed by applicant.

In view of the foregoing amendments and remarks, all of the claims now remaining in the application are deemed to be in condition for allowance and, therefore, further and favorable action is requested.

If the Examiner has any questions concerning this application, the Examiner is requested to contact William L. Gates, Reg. No. 20,848 at the telephone number of (703) 205-8000. Facsimile communications may be sent to William L. Gates at the facsimile number of (703) 205-8050.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Marked-Up Version of Claim Amendments

Claims 1, 12, 23 and 28 are amended as follows.

1. (Twice amended) A semiconductor laser element, comprising:

a semiconductor laser region including a plurality of laser emission portions each having the same construction relative to one another [identical laser emission portions] and arranged side by side in a parallel array, each of said laser emission portions including an active layer for emitting light;

a multimode interference region including a first wave-guiding layer, wherein one end of the first wave-guiding layer is spaced by an equal length or distance in an optical direction from [equidistantly optically coupled to] the active layers of the plurality of laser emission portions so as to provide an equal passage of time of light thereto from the active layers; and

an output waveguide region including a second wave-guiding layer, the second wave-guiding layer being optically coupled to an opposite end of the first wave-guiding layer of the interference region.

12. (Twice amended) A semiconductor laser element according to claim 10, wherein the first wave-guiding layer and the plurality of third wave-guiding layers are comprised of low optical absorption material [substantially non-optically absorptive material].

23. (Twice amended) A semiconductor laser element according to claim 28, wherein each of the plurality of second wave-guiding layers of the input waveguide region has a predetermined [equivalent] refractive index.

28. (Amended) A semiconductor laser element, comprising:

a semiconductor laser region including a plurality of [like] laser oscillation portions each having the same construction relative to one another, arranged side by side, and having a common modulation electrode for operating in a single mode, each of said laser oscillation portions having an active layer which performs laser operations at a same wavelength;

a multimode interference region including a first wave-guiding layer coupled to said laser oscillation portions via an input waveguide region including a plurality of parallel equal length waveguides having respective second wave-guiding layers;

an output waveguide region including a third wave-guiding layer coupled to said second wave-guiding layers;

wherein the active layer of the plurality of laser oscillation portions, the first wave-guiding layer of said multimode interference region, the

second layers of the input waveguide region, and the third layer of the output waveguide region are formed on a common substrate.